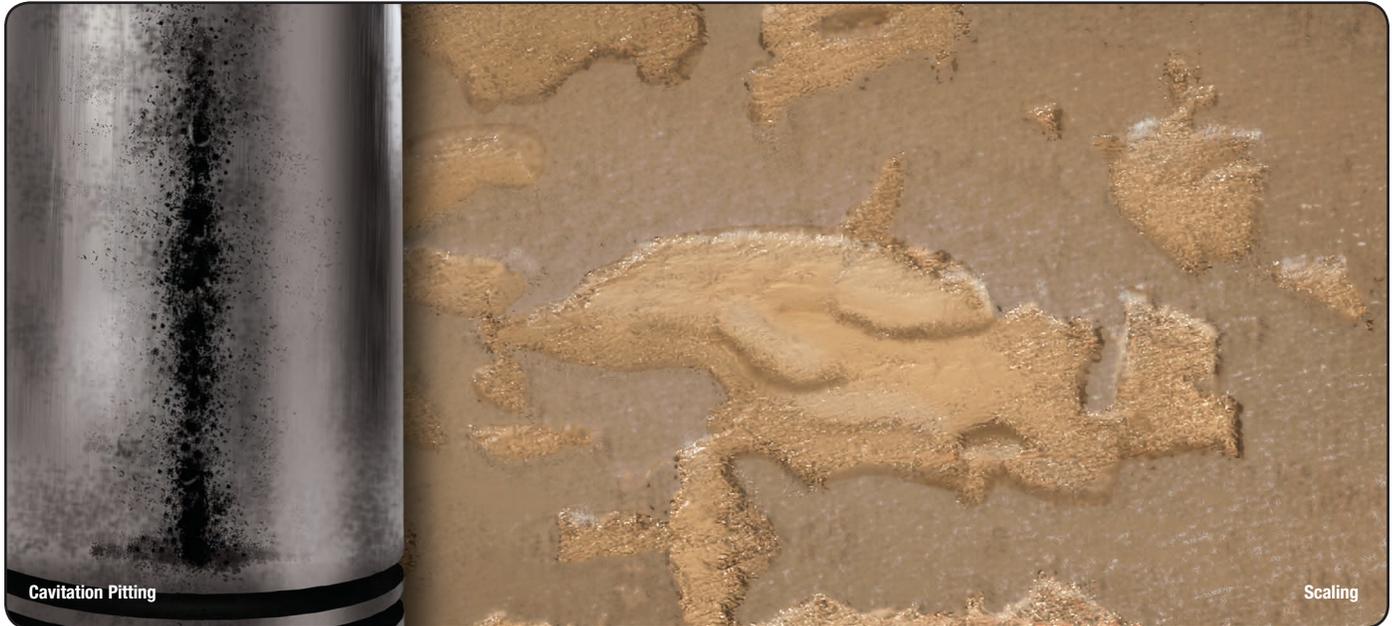


Properly Maintaining Your Heavy Duty Engine Cooling System

As today's heavy duty engines have evolved, so have the demands that have been put on maintaining the cooling systems that keep them running at the most efficient levels.

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Cavitation Pitting: Improper maintenance of a heavy duty cooling system can create many performance issues for the engine and its components, including cavitation pitting, where the metal lacks proper protection and is damaged. **Scaling:** No engine can operate efficiently with deposits on metal surfaces, which will slowly impair an engine's performance, as coolant flow can become restricted and impair the cooling process.

Introduction

The saying goes something like this: "When you take care of something good, that something good takes care of you." The same can be said for taking care of maintenance on a heavy duty engine.

Whether you are a fleet manager or an independent owner-operator, maintaining the optimum operating efficiency of any heavy duty vehicle is essential for success. Any vehicle experiencing downtime is costing its owner or manager in repair bills, as well as in earning potential and revenue. When it comes to getting the most out of your heavy duty engine, properly maintaining the various operating systems is the first step to ensure efficient and reliable performance.

Some estimates project that up to 40% of total engine repair costs are related to issues that originate within the cooling system. These repairs, which can begin from something as simple as the neglect of basic maintenance, create unnecessary downtime that affects equipment operations and customer deadlines.

Today's heavy duty engines are more sophisticated than any previous generation of equipment. While this sophistication allows the engine to address environmental issues regarding exhaust and pollutants, and to squeeze the most power out of engines that are running hotter than ever, they are also far more expensive to repair should something go wrong. To avoid unnecessary repairs, maintaining the modern-day cooling system becomes the essential link to maintaining the entire system.

Every component in the cooling system affects the performance of other vehicle components. Therefore, proper maintenance will ensure the best possible operating efficiencies. The essential tasks for any cooling system are:

- Provide efficient heat transfer and the transport of engine heat to control critical metal temperatures
- Increase the cooling index to help prevent boilover and overheating failures
- Provide freezing protection to prevent engine freeze-ups or non-starts in the lowest temperatures

- Provide effective inhibition of corrosion for all cooling-system metals through a wide range of temperatures and operating conditions

Properly maintained cooling systems may utilize several different antifreeze/coolant (AF/C) product technologies to adequately stay on track with maintenance and cooling intervals. From Conventional (Inorganic) Additive Technology (IAT) to Organic Acid Technology (OAT) formulas to Hybrid Organic Acid Technology (HOAT), cooling system AF/Cs have evolved as the sophistication of the heavy duty engine has grown.

If the cooling system is unable to satisfy essential requirements, the heavy duty vehicle's horsepower, fuel economy, emissions and overall durability may be compromised. Selecting the highest quality coolant products and replenishing at the recommended interval will ensure operating efficiency and optimal performance.

The Challenge

Intervals

The most immediate concerns for any heavy duty operators has to be maintaining their heavy duty fleet's cooling system levels with the appropriate type of antifreeze/coolant, while knowing precisely when the appropriate interval has been reached for recharging or changing the coolant.

Potential problems that can occur when using the wrong type of coolant range from oil degradation, boilover or freezing to cavitation pitting, rust/corrosion buildup or water-pump failure. Utilizing the wrong type of coolant can also initiate hose leaks, with subsequent high-volume coolant loss, reduced driving comfort and potential engine breakdown.

The American Trucking Associations' Technology & Maintenance Council (TMC) is an accepted authority for heavy duty trucking maintenance standards. The TMC's recommended (RP-365 Coolant Maintenance) guidelines are:

- Conventional pre-charged Inorganic Acid Technology (IAO) and Hybrid Organic Acid Technology (HOAT) coolants should be maintained on an engine preventive maintenance interval of 25,000 miles, or as specified by the engine manufacturer.
- Nitrited Organic Acid Technology (NOAT) coolants generally require an extended charge at 300,000 miles, or 6,000 engine hours, to achieve the full 600,000 miles or 12,000-hour service life.
- Organic Acid Technology (OAT) coolants typically provide 600,000 miles or 12,000 engine hours of service life.

Because glycol and water are naturally corrosive, coolant manufacturers add inorganic and/or organic salts and chemicals, known as corrosion inhibitors, to the coolant in order to prevent the cooling-system components from corroding. The very best AF/Cs do more than simply keep the engine from freezing up in cold temperatures or

overheating in extreme heat, they also fight metal corrosion within the engine. Rust and corrosion can ruin the efficiency of a cooling system, putting the entire engine at risk. With a myriad of different metals making up any heavy duty engine, it is important to understand the need for inhibitors in the coolant to fight rust and corrosion across all metal surfaces. The correct mixture of coolant with the proper amount and type of inhibitors will guard against corrosion.

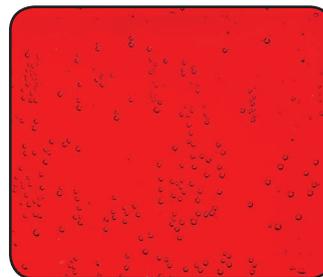
As the operation of the engine consumes corrosion-fighting additives, Supplemental Coolant Additives (SCA) must be periodically added to systems with conventional IAC and HOAT coolants to maintain effective corrosion protection.

The OAT and NOAT coolants do not require SCAs. The inhibitor package does not determine the level of freeze or boilover protection in the coolant; its only function is corrosion protection.

Cooling-system problems can result from the deterioration of any material within the engine, or supporting systems. Original Equipment Manufacturers (OEM) provide guidelines for coolants in their engines, but no engine can operate efficiently with deposits on metal surfaces, which will slowly impair an engine's performance as coolant flow can become restricted, which inhibits the system's ability to adequately cool or transfer heat from the key components. That's why it is important to determine the effect a coolant will have on the cooling system/engine parts and materials.

Coolant Colors

The TMC has established recommended colors for varying types of coolants (RP-351). While these are recommendations, the colors are not required and some manufacturers do not follow the color guidelines. The color recommendations are:



RED for Organic Acid Technology (OAT)



PURPLE/PINK for fully formulated ethylene glycol-based coolant with SCA



GREEN for conventional low-silicate coolant without SCA



BLUE for fully-formulated propylene glycol

When choosing the appropriate type of coolant, it is important to understand that you should not assume colors on the packaging are the color of the contents in the bottle. It is not uncommon to find red or purple labeling, or colored caps, on products that might not correlate to the content's color or formulation. Do not judge a book by its cover and always read the label to be sure you are buying the appropriate coolant for your system.

There are also a number of cooling-system maintenance essentials that should be considered:

1. Test coolants regularly for appropriate additive levels
2. Only utilize coolant that meets industry standards and performance requirements
3. Top off cooling systems using pre-diluted coolant and maintain additive levels at regular service intervals with liquid additives or chemically charged filters

What type of questions should you ask your coolant supplier before making purchasing decisions?

Modern antifreeze/coolant (AF/C) has undergone decades of research and development as modern engines have become more sophisticated. Add in the demands of different types of engines and operating conditions, and you can understand why it is important to seek change-interval advice from a heavy duty professional.

New cooling systems are best served when they use precisely formulated AF/Cs that have been designed to meet the demands of the current generation of heavy duty engines. Additives in an OAT coolant deplete at a much slower rate than those in fully formulated antifreeze/coolant, but extended-life antifreeze/coolant is not maintenance-free. It should be checked regularly for contamination

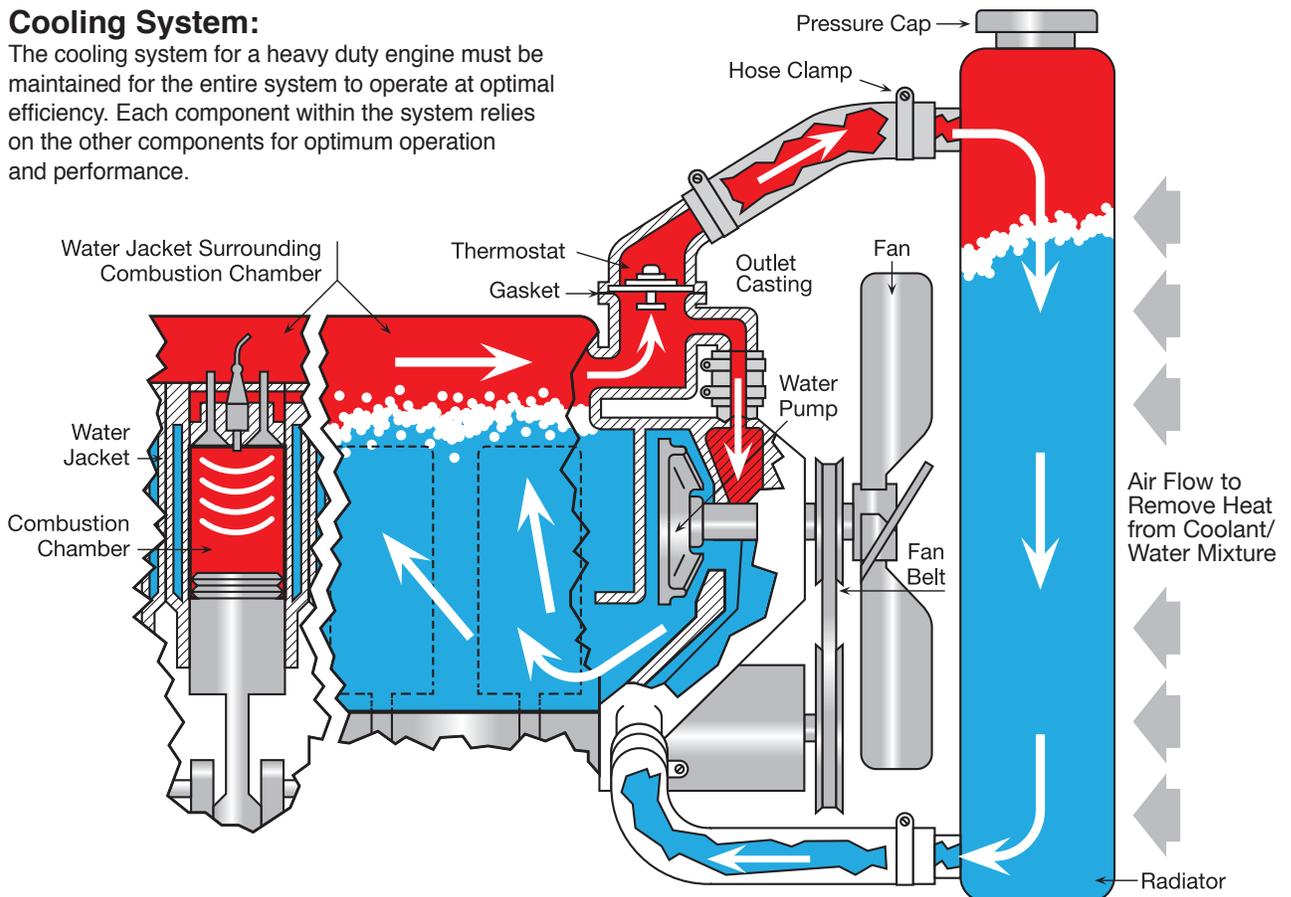
and freeze point. An "extender" additive package usually is required at the mid-point of the coolant's life.

Fully formulated extended service interval coolant must be periodically checked for freeze point (glycol content), nitrite (or nitrite/molybdate) levels, and, in some instances, pH. If makeup additives are required, a supplemental coolant additive (SCA) package is used.

A reputable distributor will work with heavy duty fleet operators to responsibly lengthen their AFC change intervals, while not jeopardizing the health and performance of their engines. Given the high-dollar investment in heavy duty equipment, decisions should always be made based on the integrity of the supplier, who develops, manufactures, distributes and stands behind the quality of its products, such as the Prestone Command® line of heavy duty antifreeze/coolants. When in doubt, every manufacturer provides engine specs and coolant recommendations.

Cooling System:

The cooling system for a heavy duty engine must be maintained for the entire system to operate at optimal efficiency. Each component within the system relies on the other components for optimum operation and performance.





The Solution

Designed especially for heavy duty use in construction, mining, oil and gas, and agricultural applications, the Prestone Command® line of coolants was developed to provide essential cooling-system protection in the most extreme conditions. Decades of industry experience have produced insights that are reflected in the research and development that went into the new Prestone Command® Extended Life Coolants. The Prestone Command® line of coolants is available in two formulations:

- **Heavy Duty Extended Life (ELC)** — this red-dyed patented antifreeze/coolant is a blend of ethylene glycol and a specially formulated OAT inhibitor package that is silicate-, phosphate- and borate-free and designed for heavy duty cooling systems. It is formulated for a service life of 600,000 miles or 12,000 hours, when an extender is added at 300,000 miles or 6,000 hours. This ELC is compatible with other ELC products as well as conventional coolants, though its extended life benefits will be reduced in those circumstances. Also available in a 50/50 formulation for convenient top-offs.
- **Heavy Duty Extended Service Interval SCA Pre-Charged (ESI)** — this purple-dyed antifreeze/coolant is a blend of ethylene glycol and a specially formulated inhibitor package that has been designed for heavy duty cooling-system applications. This ESI coolant is compatible with any conventional heavy duty coolant and all filter technologies, and will eliminate the initial pre-charge of SCAs on new vehicles and recharged systems. Also available in a 50/50 formulation for convenient top-offs.
- **Heavy Duty Nitrite Free Extended Life Antifreeze/Coolant (ELC)** – this yellow-dyed antifreeze/coolant is an Organic Acid Technology (OAT) intended for use and compatibility with any OAT Extended Life heavy duty antifreeze/coolant in any diesel powered commercial vehicle engine or stationary engine with aluminum or other engine metals. Premium long-lasting inhibitors provide up to 600,000 miles/12,000 hours of protection against temperature extremes, rust, corrosion, scale and premature water pump failure. The phosphate- and borate-free formulation provides long lasting inhibition and corrosion protection, protecting aluminum and all other engine metals. Also available in a 50/50 formulation for convenient top-offs.

Both the Prestone Command® Extended Life and Extended Service Interval SCA Pre-Charged formulations meet or exceed the performance requirements of industry specifications, including, but not limited to, ASTM D-6210, ASTM D-3306 and TMC RP- 329, along with those of numerous OEMs, such as Cummins, Navistar, Detroit Diesel and Mack.

While the Prestone Technology Center works closely with major engine manufacturers to create antifreeze/coolant formulations that are best in class, it is the only national antifreeze/coolant brand that manufactures all of its products at its own sites in the United States.

The Conclusion

The maintenance on a heavy duty engine requires an understanding of the entire cooling system that ties precision and power together. Antifreeze/coolant choices, and the intervals chosen to replenish them, are important for fighting engine-component corrosion and other ailments that deteriorate the heavy duty engine's efficiency and overall productivity. Coolant decisions can have a profound effect relating to time spent on the road — or time spent in the garage. These decisions should be made based on the integrity of the supplier who develops, manufactures, distributes and stands behind the quality of its products. When you take care of something good, that something good takes care of you.

About the Author:

Colin Dilley, Ph.D, is the Vice President of Technology for Prestone Products Corporation. Colin can be reached at: Colin.Dilley@Prestone.com. Headquartered in Lake Forest, IL, Prestone Products Corporation manufactures and markets Prestone®, a leading brand of antifreeze/coolant and related products. Prestone Command® Heavy Duty products, lead by patented antifreeze/coolant technologies, deliver value by keeping Heavy Duty truck engines in optimal condition in the most demanding heavy-duty on-road and off-road applications. Anywhere. Anytime. Any Engine™. You can find more at www.prestonecommand.com.

